

WHAT IS CLAIMED IS:

1 1. A method of equalizing a signal, wherein the
2 signal comprises a series of input blocks of coded data, the
3 method comprising at least the following steps:

4 a) shifting data in each input block of data to
5 the left;

6 b) complex multiplying each of the left shifted
7 input block of data by a first set of equalizer coefficients
8 to provide respective first adjusted output blocks of data,
9 wherein step b) is not a full solution to ghosts;

10 c) complex multiplying each of the input blocks of
11 data by a second set of equalizer coefficients to provide
12 respective second adjusted output blocks of data, wherein
13 step c) is not a full solution to ghosts;

14 d) shifting the data in each input block of data
15 to the right;

16 e) complex multiplying each of the right shifted
17 input block of data by a third set of equalizer coefficients
18 to provide respective third adjusted output blocks of data,
19 wherein step e) is not a full solution to ghosts;

20 f) adding corresponding ones of the first, second,
 21 and third adjusted output blocks of data; and,
 22 g) controlling the first, second, and third sets
 23 of equalizer coefficients so that, as a result of the
 24 addition performed according to step f), a substantially
 25 full solution to ghosts is obtained.

1 2. The method of claim 1 wherein step g)
 2 comprises the following steps:
 3 estimating the channel; and,
 4 controlling the first, second, and third sets of
 5 equalizer coefficients based upon the estimated channel.

6 3. The method of claim 1 wherein step g)
 7 comprises the step of controlling the first, second, and
 8 third sets of equalizer coefficients based upon the addition
 9 of step f).

10 4. The method of claim 1 wherein step g)
 11 comprises the following steps:
 12 g1) performing a comparison based upon the
 13 addition of step f) and the input blocks of data; and,
 14

5 g2) controlling the first, second, and third sets
6 of equalizer coefficients based upon the comparison
7 performed in step g1).

1 5. The method of claim 1 wherein step g)
2 comprises the following steps:

3 g1) comparing results of the addition of step f)
4 to a reference to form an error;

 g2) conjugating the input blocks of data;

 g3) shifting data in the conjugated input blocks
of data to the left;

 g4) shifting the data in the conjugated input
blocks of data to the right;

 g5) correlating the left shifted, conjugated input
blocks of data and the error;

 g6) correlating the conjugated input blocks of
data and the error;

 g7) correlating the right shifted, conjugated
input blocks of data and the error;

 g8) controlling the first set of equalizer
coefficients based upon the correlation performed at step
g5);

19 g9) controlling the second set of equalizer
20 coefficients based upon the correlation performed at step
21 g6); and,
22 g10) controlling the third set of equalizer
23 coefficients based upon the correlation performed at step
24 g7).

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1 9. The method of claim 1 wherein step g)
2 comprises the following steps:
3 g1) comparing results of the addition of step f)
4 to a reference to form an error;
5 g2) performing a left shift based upon the input
6 blocks of data;
7 g3) performing a right shift based upon the input
8 blocks of data;
9 g4) performing a first correlation based upon
10 results from step g2) and the error;
11 g5) performing a second correlation based upon the
12 input blocks of data and the error;
13 g6) performing a third correlation based upon
14 results from step g3) and the error;
15 g7) controlling the first set of equalizer
16 coefficients based upon the first correlation;
17 g8) controlling the second set of equalizer
18 coefficients based upon the second correlation; and,
19 g9) controlling the third set of equalizer
20 coefficients based upon the third correlation.

1 10. The method of claim 11 wherein the reference
2 is a training signal.

1 11. The method of claim 11 wherein the reference
2 is sliced data.

1 12. The method of claim 1 wherein step g)
2 comprises the following steps:
g1) conjugating the input blocks of data;
g2) shifting data in the conjugated input blocks
of data to the left;

g3) shifting the data in the conjugated input
blocks of data to the right;

g4) performing a first correlation based upon the
left shifted, conjugated input blocks of data and the
addition of step f);

g5) performing a second correlation based upon the
conjugated input blocks of data and the addition of step f);

g6) performing a third correlation based upon the
right shifted, conjugated input blocks of data and the
addition of step f);

16 g7) controlling the first set of equalizer
17 coefficients based upon the first correlation;
18 g8) controlling the second set of equalizer
19 coefficients based upon the second correlation; and,
20 g9) controlling the third set of equalizer
21 coefficients based upon the third correlation.

13. The method of claim 1 wherein step g)
comprises the following steps:

g1) performing a left shift based upon the input
blocks of data;

g2) performing a right shift based upon the input
blocks of data;

g3) performing a first correlation based upon
results from step g1) and the first, second, and third
adjusted output blocks of data;

g4) performing a second correlation based upon the
input blocks of data and the first, second, and third
adjusted output blocks of data;

g5) performing a third correlation based upon
results from step g2) and the first, second, and third
adjusted output blocks of data;

16 g6) controlling the first set of equalizer
17 coefficients based upon the first correlation;
18 g7) controlling the second set of equalizer
19 coefficients based upon the second correlation; and,
20 g8) controlling the third set of equalizer
21 coefficients based upon the third correlation.

1 14. The method of claim 1 further comprising the
2 step of h) applying pre-processing coefficients to each data
3 block prior to steps a), c), and d).
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5 15. The method of claim 14 wherein step g)
6 comprises the step of controlling a width of the pre-
7 processing coefficients so that the width of the pre-
8 processing coefficients is substantially commensurate with a
9 width of a data block and an interval between a data block
10 and a ghost.

1 16. The method of claim 14 wherein step g)
2 comprises the following steps:
3 estimating the channel; and,
4 controlling the first, second, and third sets of
5 equalizer coefficients based upon the estimated channel.

1 17. The method of claim 14 wherein step g)
2 comprises the step of controlling the first, second, and
3 third sets of equalizer coefficients based upon the addition
4 of step f).
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1 18. The method of claim 14 wherein step g)
2 comprises the following steps:
3

4 g1) performing a comparison based upon the
5 addition of step f) and the input blocks of data; and,
6

7 g2) controlling the first, second; and third sets
8 of equalizer coefficients based upon the comparison
9 performed in step g1).

19. The method of claim 14 wherein step g) comprises the following steps:

g1) comparing results of the addition of step f) to a reference to form an error;

g2) conjugating the input blocks of data;

g3) performing a correlation based upon the error and the conjugated input blocks of data; and,

g4) controlling the first, second, and third sets of equalizer coefficients based upon the correlation.

20. The method of claim 19 wherein the reference is a training signal.

21. The method of claim 19 wherein the reference is sliced data.

22. The method of claim 14 wherein step g) comprises the following steps:

g1) comparing results of the addition of step f) to a reference to form an error;

g2) conjugating the input blocks of data;

6 g3) shifting data in the conjugated input blocks
7 of data to the left;
8 g4) shifting the data in the conjugated input
9 blocks of data to the right;
10 g5) correlating the left shifted, conjugated input
11 blocks of data and the error;
12 g6) correlating the conjugated input blocks of
13 data and the error;
14 g7) correlating the right shifted, conjugated
15 input blocks of data and the error;
16 g8) controlling the first set of equalizer
17 coefficients based upon the correlation performed at step
18 g5);
19 g9) controlling the second set of equalizer
20 coefficients based upon the correlation performed at step
21 g6); and,
22 g10) controlling the third set of equalizer
23 coefficients based upon the correlation performed at step
24 g7) .

23. The method of claim 22 wherein step g5) comprises the step of down sampling the left shifted, conjugated input blocks of data, wherein step g6) comprises the step of down sampling the conjugated input blocks of data, and wherein step g7) comprises the step of down sampling the right shifted, conjugated input blocks of data.

24. The method of claim 22 wherein the reference is a training signal.

25. The method of claim 22 wherein the reference is sliced data.

26. The method of claim 14 wherein step g) comprises the following steps:

g1) comparing results of the addition of step f) to reference data to form an error;

g2) performing a left shift based upon the input blocks of data;

g3) performing a right shift based upon the input blocks of data;

9 g4) performing a first correlation based upon
 10 results from step g2) and the error;
 11 g5) performing a second correlation based upon the
 12 input blocks of data and the error;
 13 g6) performing a third correlation based upon
 14 results from step g3) and the error;
 15 g7) controlling the first set of equalizer
 16 coefficients based upon the first correlation;
 17 g8) controlling the second set of equalizer
 18 coefficients based upon the second correlation; and,
 19 g9) controlling the third set of equalizer
 20 coefficients based upon the third correlation.

27. The method of claim 26 wherein the reference
 is a training signal.

28. The method of claim 26 wherein the reference
 is sliced data.

1 29. The method of claim 21 wherein step g)
2 comprises the following steps:
3 g1) conjugating the input blocks of data;
4 g2) shifting data in the conjugated input blocks
5 of data to the left;
6 g3) shifting the data in the conjugated input
7 blocks of data to the right;
8 g4) performing a first correlation based upon the
9 left shifted, conjugated input blocks of data and the
10 addition of step f);
11 g5) performing a second correlation based upon the
12 conjugated input blocks of data and the addition of step f);
13 g6) performing a third correlation based upon the
14 right shifted, conjugated input blocks of data and the
15 addition of step f);
16 g7) controlling the first set of equalizer
17 coefficients based upon the first correlation;
18 g8) controlling the second set of equalizer
19 coefficients based upon the second correlation; and,
20 g9) controlling the third set of equalizer
21 coefficients based upon the third correlation.

1 30. The method of claim 14 wherein step g)
2 comprises the following steps:
3 g1) performing a left shift based upon the input
4 blocks of data;
5 g2) performing a right shift based upon the input
6 blocks of data;
7 g3) performing a first correlation based upon
8 results from step g1) and the first, second, and third
9 adjusted output blocks of data;
10 g4) performing a second correlation based upon the
11 input blocks of data and the first, second, and third
12 adjusted output blocks of data;
13 g5) performing a third correlation based upon
14 results from step g2) and the first, second, and third
15 adjusted output blocks of data;
16 g6) controlling the first set of equalizer
17 coefficients based upon the first correlation;
18 g7) controlling the second set of equalizer
19 coefficients based upon the second correlation; and,
20 g8) controlling the third set of equalizer
21 coefficients based upon the third correlation.

1 31. The method of claim 14 wherein the pre-
2 processing coefficients are curved.

1 32. The method of claim 14 wherein the pre-
2 processing coefficients are curved substantially according
3 to a function $1/(2 - \cos(t))$.

1 33. The method of claim 1 further comprising the
2 step of applying a spectral transformation to each data
3 block prior to steps a), c), and d), wherein the spectral
4 transformation is longer than a data block.

1 34. An equalizer for processing blocks of data
2 comprising:

3 n - 1 data shifters, wherein each of the n - 1
4 data shifters shifts the blocks of data;

5 n finite filters, wherein one of the n finite
6 filters applies a corresponding set of finite filter
7 coefficients to the blocks of data, wherein each of the
8 other n - 1 finite filters applies a set of finite filter
9 coefficients to a corresponding output of the n - 1 data
10 shifters, wherein ghosts of the blocks of data are not

eliminated as a result of the application of the sets of
finite filter coefficients corresponding to the n finite
filters, and wherein $n > 2$;

an adder arranged to add outputs from the n finite
filters; and,

a controller arranged to control the sets of
finite filter coefficients corresponding to the n finite
filters so that the addition performed by the adder
substantially eliminates the ghosts.

35. The equalizer of claim 34 wherein the
controller comprises a channel estimator that estimates the
channel through which the blocks of data are transmitted.

36. The equalizer of claim 34 wherein the
controller controls the n sets of finite filter coefficients
based upon an output of the adder.

37. The equalizer of claim 34 wherein the
controller comprises a comparator that performs a comparison
based upon an output of the adder and the blocks of data.

1 38. The equalizer of claim 34 wherein the
2 controller comprises:

3 a comparator arranged to compare an output of the
4 adder to a reference to form an error;

5 a conjugator arranged to conjugate the blocks of
6 data;

7 n - 1 data shifters arranged to shift the
8 conjugated blocks of data; and,

9 n correlators arranged to perform n - 1
10 correlations of the shifted, conjugated blocks of data and
11 the error and to perform one correlation of the conjugated
12 blocks of data and the error, wherein each of the n
13 correlators is arranged to control a corresponding set of
14 equalizer coefficients.

1 39. The equalizer of claim 38 wherein the
2 controller further comprises n down samplers, wherein n - 1
3 of the n down samplers are arranged to down sample the
4 shifted, conjugated blocks of data prior upstream of the
5 correlators, and wherein the other down sampler is arranged
6 to down sample the conjugated blocks of data upstream of the
7 correlators.

1 40. The equalizer of claim 38 wherein the
2 reference is a training signal.

1 41. The equalizer of claim 38 wherein the
2 reference is sliced data.

1 42. The equalizer of claim 34 wherein the
2 controller comprises:

 a comparator arranged to compare an output of the
adder to a reference to form an error;

 n - 1 data shifters arranged to shift the blocks
of data; and,

 n correlators arranged to perform n - 1
correlations based upon the shifted blocks of data and the
error and to perform one correlation based upon the blocks
of data and the error, wherein each of the n correlators is
arranged to control a corresponding set of equalizer
coefficients.

1 43. The equalizer of claim 42 wherein the
2 reference is a training signal.

1 44. The equalizer of claim 42 wherein the
2 reference is sliced data.

1 45. The equalizer of claim 34 wherein the
2 controller comprises:

3 a conjugator arranged to conjugate the blocks of
4 data;

5 n - 1 data shifters arranged to shift the
6 conjugated blocks of data;

7 n correlators arranged to perform n - 1
8 correlations based upon the shifted, conjugated blocks of
9 data and an output of the adder and to perform one
10 correlation based upon the conjugated blocks of data and the
11 output of the adder, wherein each of the n correlators is
12 arranged to control a corresponding set of equalizer
13 coefficients.

1 46. The equalizer of claim 34 wherein the
2 controller comprises:

3 n - 1 data shifters arranged to shift the blocks
4 of data; and,

5 n correlators arranged to perform $n - 1$
6 correlations based upon the shifted blocks of data and an
7 output of the adder and to perform one correlation based
8 upon the blocks of data and the output of the adder, wherein
9 each of the n correlators is arranged to control a
10 corresponding set of equalizer coefficients.

1 47. The equalizer of claim 34 further comprising
2 a pre-processor that applies pre-processor coefficients to
3 each data block upstream of the $n - 1$ data shifters and the
4 n finite filters.

5 48. The equalizer of claim 47 wherein the
6 controller controls a width of the pre-processing
7 coefficients so that the width is substantially coincident
8 with the width of a data block and an interval between a
9 data block and a ghost.

1 49. The equalizer of claim 47 wherein the pre-
2 processing coefficients are curved.

1 50. The equalizer of claim 47 wherein the pre-
2 processing coefficients are curved substantially according
3 to a function $1/(2 - \cos(t))$.

1 51. The equalizer of claim 47 wherein the
2 controller comprises a channel estimator that estimates the
3 channel through which the blocks of data are transmitted.

1 52. The equalizer of claim 47 wherein the
2 controller controls the n sets of finite filter coefficients
3 based upon an output of the adder.

1 53. The equalizer of claim 47 wherein the
2 controller comprises a comparator that performs a comparison
3 based upon an output of the adder and the blocks of data.

1 54. The equalizer of claim 47 wherein the
2 controller comprises:
3 a comparator arranged to compare an output of the
4 adder to a reference to form an error;
5 a conjugator arranged to conjugate the blocks of
6 data;

7 n - 1 data shifters arranged to shift the

8 conjugated blocks of data; and,

9 n correlators arranged to perform n - 1

10 correlations of the shifted, conjugated blocks of data and

11 the error and to perform one correlation of the conjugated

12 blocks of data and the error, wherein each of the n

13 correlators is arranged to control a corresponding set of

14 equalizer coefficients.

55. The equalizer of claim 54 wherein the
controller further comprises n down samplers, wherein n - 1
of the n down samplers are arranged to down sample the
shifted, conjugated blocks of data prior upstream of the
correlators, and wherein the other down sampler is arranged
to down sample the conjugated blocks of data upstream of the
correlators.

56. The equalizer of claim 54 wherein the
reference is a training signal.

57. The equalizer of claim 54 wherein the
reference is sliced data.

1 58. The equalizer of claim 47 wherein the
2 controller comprises:

3 a comparator arranged to compare an output of the
4 adder to a reference to form an error;

5 n - 1 data shifters arranged to shift the blocks
6 of data; and,

7 n correlators arranged to perform n - 1
8 correlations based upon the shifted blocks of data and the
9 error and to perform one correlation based upon the blocks
10 of data and the error, wherein each of the n correlators is
11 arranged to control a corresponding set of equalizer
12 coefficients.
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2 59. The equalizer of claim 58 wherein the
reference is a training signal.

1 60. The equalizer of claim 58 wherein the
2 reference is sliced data.

1 61. The equalizer of claim 47 wherein the
2 controller comprises:

3 a conjugator arranged to conjugate the blocks of
4 data;

5 n - 1 data shifters arranged to shift the
6 conjugated blocks of data;

7 n correlators arranged to perform n - 1
8 correlations based upon the shifted, conjugated blocks of
9 data and an output of the adder and to perform one
10 correlation based upon the conjugated blocks of data and the
11 output of the adder, wherein each of the n correlators is
12 arranged to control a corresponding set of equalizer
13 coefficients.

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each of the n correlators is arranged to control a
corresponding set of equalizer coefficients.

63. The equalizer of claim 34 wherein $n > 4$.

64. The equalizer of claim 34 further comprising
a spectral transformation applied to each data block
upstream of the $n - 1$ data shifters and the n finite
filters, wherein the spectral transformation is longer than
a block of data.

65. An equalizer for processing blocks of data
comprising:

a first data shifter, wherein the first data
shifter is arranged to shift the data left by two;

a second data shifter, wherein the second data
shifter is arranged to shift the data left by one;

a third data shifter, wherein the third data
shifter is arranged to shift the data right by one;

a fourth data shifter, wherein the fourth data
shifter is arranged to shift the data right by two;

11 a first finite filter, wherein the first finite
12 filter applies a first set of finite filter coefficients to
13 each of the blocks of data which have been shifted by the
14 first data shifter, wherein ghosts of the blocks of data are
15 not eliminated as a result of the application of the first
16 set of finite filter coefficients;

17 a second finite filter, wherein the second finite
18 filter applies a second set of finite filter coefficients to
19 each of the blocks of data which have been shifted by the
20 second data shifter, wherein ghosts of the blocks of data
21 are not eliminated as a result of the application of the
22 second set of finite filter coefficients;

23 a third finite filter, wherein the third finite
24 filter applies a third set of finite filter coefficients to
25 each of the blocks of data, wherein ghosts of the blocks of
26 data are not eliminated as a result of the application of
27 the third set of finite filter coefficients;

28 a fourth finite filter, wherein the fourth finite
29 filter applies a fourth set of finite filter coefficients to
30 each of the blocks of data which have been shifted by the
31 third data shifter, wherein ghosts of the blocks of data are

32 not eliminated as a result of the application of the fourth
33 set of finite filter coefficients;

34 a fifth finite filter, wherein the fifth finite
35 filter applies a fifth set of finite filter coefficients to
36 each of the blocks of data which have been shifted by the
37 fourth data shifter, wherein ghosts of the blocks of data
38 are not eliminated as a result of the application of the
39 fifth set of finite filter coefficients;

40 an adder arranged to add outputs from the first,
41 second, third, fourth, and fifth finite filters; and,

42 a controller arranged to control the first,
43 second, third, fourth, and fifth sets of finite filter
44 coefficients so that the addition performed by the adder
45 substantially eliminates the ghosts.

1 66. The equalizer of claim 65 wherein the
2 controller comprises a channel estimator that estimates the
3 channel through which the blocks of data are transmitted.

67. The equalizer of claim 65 wherein the controller controls the first, second, third, fourth, and fifth sets of finite filter coefficients based upon an output of the adder.

68. The equalizer of claim 65 wherein the controller comprises a comparator that performs a comparison based upon an output of the adder and the blocks of data.

69. The equalizer of claim 65 wherein the controller comprises:

a comparator arranged to compare an output of the adder to a reference to form an error;

a conjugator arranged to conjugate the blocks of data;

a first data shifter arranged to shift the conjugated blocks of data left by two;

a second data shifter arranged to shift the conjugated blocks of data left by one;

a third data shifter arranged to shift the conjugated blocks of data right by one;

13 a fourth data shifter arranged to shift the
14 conjugated blocks of data right by two;

15 a first correlator arranged to perform a
16 correlation of the error and the conjugated blocks of data
17 shifted by the first data shifter, wherein the first
18 correlator is arranged to control the first set of finite
19 filter coefficients;

20 a second correlator arranged to perform a
21 correlation of the error and the conjugated blocks of data
22 shifted by the second data shifter, wherein the second
23 correlator is arranged to control the second set of finite
24 filter coefficients;

25 a third correlator arranged to perform a
26 correlation of the error and the conjugated blocks of data,
27 wherein the third correlator is arranged to control the
28 third set of finite filter coefficients;

29 a fourth correlator arranged to perform a
30 correlation of the error and the conjugated blocks of data
31 shifted by the third data shifter, wherein the fourth
32 correlator is arranged to control the fourth set of finite
33 filter coefficients; and,

34 a fifth correlator arranged to perform a
35 correlation of the error and the conjugated blocks of data
36 shifted by the fourth data shifter, wherein the fifth
37 correlator is arranged to control the fifth set of finite
38 filter coefficients.

1 70. The equalizer of claim 69 wherein the
2 controller further comprises a down sampler upstream of each
3 of the first, second, third, fourth, and fifth correlators,
4 wherein the down samplers are arranged to down sample the
5 conjugated blocks of data.

6 71. The equalizer of claim 69 wherein the
7 reference is a training signal.

8 72. The equalizer of claim 69 wherein the
9 reference is sliced data.

10 73. The equalizer of claim 65 wherein the
11 controller comprises:

12 a comparator arranged to compare an output of the
13 adder to a reference to form an error;
14

5 a first data shifter arranged to perform a shift
6 left by two based upon the blocks of data;

7 a second data shifter arranged to perform a shift
8 left by one based upon the blocks of data;

9 a third data shifter arranged to perform a shift
10 right by one based upon the blocks of data;

11 a fourth data shifter arranged to perform a shift
12 right by two based upon the blocks of data;

13 a first correlator arranged to perform a
14 correlation of an output of the first data shifter and the
15 error, wherein the first correlator is arranged to control
16 the first set of finite filter coefficients;

17 a second correlator arranged to perform a
18 correlation of an output of the second data shifter and the
19 error, wherein the second correlator is arranged to control
20 the second set of finite filter coefficients;

21 a third correlator arranged to perform a
22 correlation based upon the blocks of data and the error,
23 wherein the third correlator is arranged to control the
24 third set of finite filter coefficients;

25 a fourth correlator arranged to perform a
26 correlation of an output of the third data shifter and the

27 error, wherein the fourth correlator is arranged to control
28 the fourth set of finite filter coefficients; and,
29 a fifth correlator arranged to perform a
30 correlation of an output of the fourth data shifter and the
31 error, wherein the fifth correlator is arranged to control
32 the fifth set of finite filter coefficients.

74. The equalizer of claim 73 wherein the
reference is a training signal.

75. The equalizer of claim 73 wherein the
reference is sliced data.

76. The equalizer of claim 65 wherein the
controller comprises:

a conjugator arranged to conjugate the blocks of
data;

a first data shifter arranged to shift the
conjugated blocks of data left by two;

a second data shifter arranged to shift the
conjugated blocks of data left by one;

9 a third data shifter arranged to shift the
10 conjugated blocks of data right by one;

11 a fourth data shifter arranged to shift the
12 conjugated blocks of data right by two;

13 a first correlator arranged to perform a
14 correlation based upon an output of the adder and the
15 conjugated blocks of data shifted by the first data shifter,
16 wherein the first correlator is arranged to control the
17 first set of finite filter coefficients;

18 a second correlator arranged to perform a
19 correlation based upon the output of the adder and the
20 conjugated blocks of data shifted by the second data
21 shifter, wherein the second correlator is arranged to
22 control the second set of finite filter coefficients;

23 a third correlator arranged to perform a
24 correlation based upon the output of the adder and the
25 conjugated blocks of data, wherein the third correlator is
26 arranged to control the third set of finite filter
27 coefficients;

28 a fourth correlator arranged to perform a
29 correlation based upon the output of the adder and the
30 conjugated blocks of data shifted by the third data shifter,

31 wherein the fourth correlator is arranged to control the
 32 fourth set of finite filter coefficients; and,
 33 a fifth correlator arranged to perform a
 34 correlation based upon the output of the adder and the
 35 conjugated blocks of data shifted by the fourth data
 36 shifter, wherein the fifth correlator is arranged to control
 37 the fifth set of finite filter coefficients.

77. The equalizer of claim 65 wherein the
 controller comprises:

a first data shifter arranged to perform a shift,
 left by two operation based upon the blocks of data;

a second data shifter arranged to perform a shift
 left by one operation based upon the blocks of data;

a third data shifter arranged to perform a shift
 right by one operation based upon the blocks of data;

a fourth data shifter arranged to perform a shift
 right by two operation based upon the blocks of data;

a first correlator arranged to perform a
 correlation based upon an output of the adder and an output
 of the first data shifter, wherein the first correlator is

14 arranged to control the first set of finite filter
15 coefficients;

16 a second correlator arranged to perform a
17 correlation based upon the output of the adder and an output
18 of the second data shifter, wherein the second correlator is
19 arranged to control the second set of finite filter
20 coefficients;

21 a third correlator arranged to perform a
22 correlation based upon the output of the adder and the
23 blocks of data, wherein the third correlator is arranged to
24 control the third set of finite filter coefficients;

25 a fourth correlator arranged to perform a
26 correlation based upon the output of the adder and an output
27 of the third data shifter, wherein the fourth correlator is
28 arranged to control the fourth set of finite filter
29 coefficients; and,

30 a fifth correlator arranged to perform a
31 correlation based upon the output of the adder and an output
32 of the fourth data shifter, wherein the fifth correlator is
33 arranged to control the fifth set of finite filter
34 coefficients.

1 78. The equalizer of claim 65 further comprising
2 a pre-processor that applies pre-processor coefficients to
3 each block of data upstream of the first, second, third, and
4 fourth data shifters and upstream of the third finite
5 filter, wherein the controller controls a width of the pre-
6 processing coefficients so that the width is substantially
7 coincident with the width of a block of data and an interval
8 between a block of data and a ghost.

9 79. The equalizer of claim 78 wherein the
10 controller comprises a channel estimator that estimates the
11 channel through which the blocks of data are transmitted.

12 80. The equalizer of claim 78 wherein the
13 controller controls the first, second, third, fourth, and
14 fifth sets of finite filter coefficients based upon an
15 output of the adder.

1 81. The equalizer of claim 78 wherein the
2 controller comprises a comparator that performs a comparison
3 based upon an output of the adder and the blocks of data.

1 82. The equalizer of claim 78 wherein the
2 controller comprises:

3 a comparator arranged to compare an output of the
4 adder to a reference to form an error;

5 a conjugator arranged to conjugate the blocks of
6 data;

7 a first data shifter arranged to shift the
8 conjugated blocks of data left by two;

9 a second data shifter arranged to shift the
10 conjugated blocks of data left by one;

11 a third data shifter arranged to shift the
12 conjugated blocks of data right by one;

13 a fourth data shifter arranged to shift the
14 conjugated blocks of data right by two;

15 a first correlator arranged to perform a
16 correlation of the error and the conjugated blocks of data
17 shifted by the first data shifter, wherein the first
18 correlator is arranged to control the first set of finite
19 filter coefficients;

20 a second correlator arranged to perform a
21 correlation of the error and the conjugated blocks of data
22 shifted by the second data shifter, wherein the second

23 correlator is arranged to control the second set of finite
24 filter coefficients;

25 a third correlator arranged to perform a
26 correlation of the error and the conjugated blocks of data,
27 wherein the third correlator is arranged to control the
28 third set of finite filter coefficients;

29 a fourth correlator arranged to perform a
30 correlation of the error and the conjugated blocks of data
31 shifted by the third data shifter, wherein the fourth
32 correlator is arranged to control the fourth set of finite
33 filter coefficients; and,

34 a fifth correlator arranged to perform a
35 correlation of the error and the conjugated blocks of data,
36 shifted by the fourth data shifter, wherein the fifth
37 correlator is arranged to control the fifth set of finite
38 filter coefficients.

1 83. The equalizer of claim 82 wherein the
2 controller further comprises a down sampler upstream of each
3 of the first, second, third, fourth, and fifth correlators,
4 wherein the down samplers are arranged to down sample the
5 conjugated blocks of data prior.

1 84. The equalizer of claim 82 wherein the
2 reference is a training signal.

1 85. The equalizer of claim 82 wherein the
2 reference is sliced data.

1 86. The equalizer of claim 78 wherein the
2 controller comprises:

3 a comparator arranged to compare an output of the
4 adder to a reference to form an error;

5 a first data shifter arranged to perform a shift
6 left by two based upon the blocks of data;

7 a second data shifter arranged to perform a shift
8 left by one based upon the blocks of data;

9 a third data shifter arranged to perform a shift
10 right by one based upon the blocks of data;

11 a fourth data shifter arranged to perform a shift
12 right by two based upon the blocks of data;

13 a first correlator arranged to perform a
14 correlation of the error and an output of the first data

15 shifter, wherein the first correlator is arranged to control
16 the first set of finite filter coefficients;

17 a second correlator arranged to perform a
18 correlation of the error and an output of the second data
19 shifter, wherein the second correlator is arranged to
20 control the second set of finite filter coefficients;

21 a third correlator arranged to perform a
22 correlation based upon the error and the blocks of data,
23 wherein the third correlator is arranged to control the
24 third set of finite filter coefficients;

25 a fourth correlator arranged to perform a
26 correlation of the error and an output of the third data
27 shifter, wherein the fourth correlator is arranged to
28 control the fourth set of finite filter coefficients; and,

29 a fifth correlator arranged to perform a
30 correlation of the error and an output of the fourth data
31 shifter, wherein the fifth correlator is arranged to control
32 the fifth set of finite filter coefficients.

1 87. The equalizer of claim 86 wherein the
2 reference is a training signal.

1 88. The equalizer of claim 86 wherein the
2 reference is sliced data.

1 89. The equalizer of claim 78 wherein the
2 controller comprises:

3 a conjugator arranged to conjugate the blocks of
4 data;

5 a first data shifter arranged to shift the
6 conjugated blocks of data left by two;

7 a second data shifter arranged to shift the
8 conjugated blocks of data left by one;

9 a third data shifter arranged to shift the
10 conjugated blocks of data right by one;

11 a fourth data shifter arranged to shift the
12 conjugated blocks of data right by two;

13 a first correlator arranged to perform a
14 correlation based upon an output of the adder and the
15 conjugated blocks of data shifted by the first data shifter,
16 wherein the first correlator is arranged to control the
17 first set of finite filter coefficients;

18 a second correlator arranged to perform a
19 correlation based upon the output of the adder and the

20 conjugated blocks of data shifted by the second data
21 shifter, wherein the second correlator is arranged to
22 control the second set of finite filter coefficients;

23 a third correlator arranged to perform a
24 correlation based upon the output of the adder and the
25 conjugated blocks of data, wherein the third correlator is
26 arranged to control the third set of finite filter
27 coefficients;

28 a fourth correlator arranged to perform a
29 correlation based upon the output of the adder and the
30 conjugated blocks of data shifted by the third data shifter,
31 wherein the fourth correlator is arranged to control the
32 fourth set of finite filter coefficients; and,

33 a fifth correlator arranged to perform a
34 correlation based upon the output of the adder and the
35 conjugated blocks of data shifted by the fourth data
36 shifter, wherein the fifth correlator is arranged to control
37 the fifth set of finite filter coefficients.

1 90. The equalizer of claim 78 wherein the
2 controller comprises:

3 a first data shifter arranged to perform a shift
4 left by two operation based upon the blocks of data;

5 a second data shifter arranged to perform a shift
6 left by one operation based upon the blocks of data;

7 a third data shifter arranged to perform a shift
8 right by one operation based upon the blocks of data;

9 a fourth data shifter arranged to perform a shift
10 right by two operation based upon the blocks of data;

11 a first correlator arranged to perform a
12 correlation based upon an output of the adder and an output
13 of the first data shifter, wherein the first correlator is
14 arranged to control the first set of finite filter
15 coefficients;

16 a second correlator arranged to perform a
17 correlation based upon the output of the adder and an output
18 of the second data shifter, wherein the second correlator is
19 arranged to control the second set of finite filter
20 coefficients;

21 a third correlator arranged to perform a
22 correlation based upon the output of the adder and the

blocks of data, wherein the third correlator is arranged to control the third set of finite filter coefficients;

a fourth correlator arranged to perform a correlation based upon the output of the adder and an output of the third data shifter, wherein the fourth correlator is arranged to control the fourth set of finite filter coefficients; and,

a fifth correlator arranged to perform a correlation based upon the output of the adder and an output of the fourth data shifter, wherein the fifth correlator is arranged to control the fifth set of finite filter coefficients.

91. The equalizer of claim 78 wherein the pre-processing coefficients are curved.

92. The equalizer of claim 78 wherein the pre-processing coefficients are curved substantially according to a function $1/(2 - \cos(t))$.

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